

ANN BAVENDER*
ANNE GOODWIN CRUMP*
VINCENT J. CURTIS, JR.
RICHARD J. ESTEVEZ
PAUL J. FELDMAN*
ERIC FISHMAN*
RICHARD HILDRETH
FRANK R. JAZZO
ANDREW S. KERSTING*
KATHRYN A. KLEIMAN
EUGENE M. LAWSON, JR.
HARRY C. MARTIN
GEORGE PETRUTSAS
LEONARD R. RAISH
JAMES P. RILEY
KATHLEEN VICTORY*
HOWARD M. WEISS
* NOT ADMITTED IN VIRGINIA

ORIGINAL
FLETCHER, HEALD & HILDRETH, P.L.C.
ATTORNEYS AT LAW

11th FLOOR, 1300 NORTH 17th STREET
ROSSLYN, VIRGINIA 22209-3801

(703) 812-0400

TELECOPIER

(703) 812-0486

INTERNET

office@fhh-telcomlaw.com

December 16, 1996

RECEIVED

DEC 16 1996

Federal Communications Commission
Office of Secretary

FRANK U. FLETCHER
(1939-1985)
ROBERT L. HEALD
(1958-1983)
PAUL D. P. SPEARMAN
(1936-1982)
FRANK ROBERSON
(1936-1961)
RUSSELL ROWELL
(1948-1977)

RETIRED
EDWARD F. KENEHAN

CONSULTANT FOR INTERNATIONAL AND
INTERGOVERNMENTAL AFFAIRS
SHELDON J. KRYS
U. S. AMBASSADOR (ret.)

OF COUNSEL
EDWARD A. CAINE*

WRITER'S NUMBER
(703) 812-

0403

VIA HAND DELIVERY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, DC 20554

DOCKET FILE COPY ORIGINAL

Re: Amendment of the Commission's Rules to Establish Part 27,
The Wireless Communication Service
GN Docket No. 96-228

Dear Mr. Caton:

Enclosed, please find the original and four copies of the Reply Comments of
Cornell University in GN Docket No. 96-228.

If you have any questions regarding this matter, please contact the undersigned.

Very truly yours,



Paul J. Feldman
Counsel for Cornell University

PJF/jr
Enclosures

No. of Copies rec'd
List ABCDE

024

ORIGINAL

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

RECEIVED

DEC 16 1996

Federal Communications Commission
Office of Secretary

In the Matter of

Amendment of the Commission's Rules to
Establish Part 27, the Wireless
Communication Service

)
)
)
)
)

GN Docket No. 96-228

REPLY COMMENTS OF CORNELL UNIVERSITY

I. Introduction

Cornell University ("Cornell"), which operates the Arecibo Radio Astronomy Observatory (the "Arecibo Observatory") in Arecibo, Puerto Rico, under the terms of a cooperative agreement with the National Science Foundation ("NSF"), hereby offers its Comments on the above-captioned matter.

In its Notice of Proposed Rulemaking ("NPRM"), released November 12, 1996, the Commission proposes to establish a new Wireless Communication Service ("WCS") in the 2305-2320 and 2345-2360 MHz bands. The Commission further proposes to permit the WCS licensee to provide a variety of fixed, mobile, radiolocation and satellite Digital Audio Radio ("Satellite DARS") services. The Commission also proposes to establish service and technical rules to ensure that harmful interference is not caused to other radio services.

As explained below, Cornell is highly concerned about the interference that WCS emissions could cause to planetary radar studies being conducted at the Arecibo Observatory in the 2370-2390 MHz band. This NPRM comes at a time when the planetary radar capabilities at the Arecibo Observatory are being upgraded with a significant amount of federal funding. Radar echoes of planetary surfaces contain unique information about the surface properties, the orbit, and the size of planetary objects. This radar technique has been successfully applied to all nearby planets as well as comets and asteroids. The particular services proposed for WCS may be less susceptible to mutual interference if digital technology is being used. However, the planetary radar at Arecibo is equally susceptible to digital emissions as it is to non-digital emissions.

From the DARS proceeding and from Comments in this proceeding by potential DARS operators, it appears imminent that DARS will be allowed to operate in the 2345-

2360 MHz band. Cornell is concerned that DARS operations in this band will negatively affect planetary radar observations at the Arecibo Observatory. Furthermore, comments from potential DARS operators¹ suggest that proposed fixed and mobile WCS operations will require more stringent limits in order to protect DARS operations. Cornell suggests that more stringent emission limits should also be applied to the upper end of the WCS fixed and mobile operations band.

II. Radar Studies At The Arecibo Observatory

The Arecibo Observatory, which is part of the National Astronomy and Ionosphere Center (a federally owned national research center) is the largest radio/radar telescope in the world. The replacement cost today is estimated at more than \$100 million. The annual operating budget, supplied by the NSF and supplemented for planetary radar research by NASA, is currently approximately \$10 million.

A new Gregorian Upgrade initiative aimed at upgrading the telescope for higher sensitivity and lower system temperatures is nearing completion and is being funded by the NSF and NASA for approximately \$25 million. The Upgrade program centers on the replacement of one of the two antenna/receiver houses by a Gregorian subreflector system, allowing operation from 300 MHz to 10 GHz. This subreflector system, serving as the secondary and tertiary in the optics, will be housed in an 86 foot diameter space frame. The Arecibo Observatory is by far the largest aperture radio/radar telescope in the world and plays a leading role as a versatile research instrument in radiophysics.

Planetary studies will make use of a 1 MW S-band transmitter which, with the reflector's forward gain of 73 dB, is the world's most powerful radar. Achievements in this field at the Arecibo Observatory include detailed maps of Venus, the recent discovery of ice caps on Mercury, and images of the large icy satellites of Jupiter. And while the potential danger to the Earth posed by small asteroids has recently received considerable publicity, the Arecibo Observatory's 2380 MHz radar is the foremost radar system in the world capable of detecting these objects and providing the ability to predict their future orbits.

The S-band radar at Arecibo Observatory operates at 2380 MHz using an instantaneous bandwidth of 20 MHz. The doubling of the transmitter power to 1 MW and the lowering of the system temperature achieved in the Gregorian Upgrade program will allow extremely high time resolution (0.1 microsecond) measurements of objects such as nearby asteroids. NASA's interest in the Gregorian Upgrade lies

¹ See, e.g., Comments of Digital Satellite Broadcasting Corporation, American Mobile Radio Corporation, and Primosphere Limited Partnership.

specifically with the increased capabilities of the planetary radar program at the Observatory.

III. DARS Sideband Emissions Must Be Sufficiently Filtered In Order To Prevent Interference To Radar Astronomy Operations In The 2370-2390 MHz Band.

Cornell University previously submitted its comments in the proceedings for the establishment of service rules for the satellite DARS service in GEN Docket 90-357. In its comments, Cornell already argued for the need to protect the sensitive radar operations of the Arecibo Observatory in the 2370-2390 MHz band.

Interference in the 2370-2390 MHz band can be caused by DARS transmissions from geostationary satellites covering the continental U.S. Such emissions may be attenuated by at least 7 dB in Puerto Rico because the island lies sufficiently far from the center of the footprint. Nevertheless, Cornell is concerned that under the proposed rules in Section 27.53(b)² for the DARS sideband emissions from any of the frequency channels in the DARS band will spill into the band used for planetary radar astronomy. The planetary radar system is used in a distinct transmit-receive mode of coded pulse train signals, and DARS sideband emissions could interfere with the detection and decoding of the returning signal from the planetary object.

Sideband emission, if unfiltered, from the upper frequency DARS channels will add a few percent to the system temperature over the 2370-2390 MHz band of the Arecibo Observatory radar system, and can potentially result in a significant decrease in sensitivity for the system. A deterministic component within the unfiltered DARS sideband emission could be very harmful for planetary radar observations. Such spectral structure could mimic the type of information to be received from the planetary surface and will be particularly harmful in terms of detecting weak signals from comets and asteroids. Circularly polarized DARS emissions may further affect the essential polarization information in the planetary data and may inhibit a proper interpretation of this information.

The spurious emission limits proposed in Section 27.55(b) and as currently adopted for Space Services in the recent proceedings in ITU-R Task Group 1-3 ("TG1-3") are inadequate to sufficiently protect the planetary radar observations at the Observatory. Suppression of at least 54 dB beyond 2370 MHz above the DARS frequency channel edge would be required to alleviate these harmful effects. The Commission's Rules in Section 25.202(f) require a spurious emission suppression of $43 + 10 \log (p)$ dB. This rule applies for emissions beyond 2375 MHz for an upper DARS

² Proposed Section 27.53(b) references and incorporates the spurious emission limits in Section 25.202(f).

channel at 2351-2359 MHz but for all other DARS channels beyond 2370 MHz. The harmful interference threshold of -233 dB (W/m²/Hz) for the radio astronomy service described in ITU-R RA.769 and the ITU Radio Astronomy Handbook apply well to radar operations at the Observatory. These limits require at least 54 dB rather than 43 dB attenuation for an assumed DARS spfd of -136 dB (W/m²/4kHz) on the surface of the Earth further attenuated by 7 dB in Puerto Rico. The out-of-band emission mask described in Section 25.202(f) further prescribes an attenuation of 35 dB in the 2370-2375 MHz band.

Cornell again requests that the Commission establish specific protection criteria for DARS operations within the WCS service rules in order to protect the planetary radar operations at the Arecibo Observatory in Puerto Rico. Although technically the DARS emissions in the 2370-2375 MHz band would fall under out-of-band emission, Cornell requests that the DARS signals in Puerto Rico be attenuated by at least 54 dB above the 2370 MHz band edge. This required attenuation is for an assumed DARS spfd of -143 dB (W/m²/4kHz) in Puerto Rico.

To this end and analogous to the interference protection criteria described above, Cornell suggests that the proposed Section 27.53(b) be modified as follows:

- (b) For WCS satellite DARS operations: The limits set forth in Section 25.202(f) of this chapter apply, except that above 2370 MHz, the attenuation must be $54 + 10 \log (p)$ dB.

Alternatively, Cornell would suggest a maximum spectral power flux density of -197 dB (W/m²/4kHz) above 2370 MHz.

IV. Sideband Emissions For Mobile And Fixed WCS Services Must Be Sufficiently Filtered To Prevent Interference To Radar Astronomy Operations In The 2370-2390 MHz Band.

In order to provide protection to existing operations in adjacent bands, the NPRM also proposes specific rules on unwanted emissions from WCS operations. The Commission specifically mentions the Government Deep Space Network ("DSN") receivers at 2290-2300 MHz and Government and commercial telemetry above 2360 MHz. NPRM at para. 33. However, the WCS proposals fail to take into account the needs of the planetary radar operations at the Arecibo Observatory. The protection requirements for the planetary radar operations at Arecibo Observatory are the same as those for the Deep Space Network. In this context, Cornell questions the omission of the protection considerations for the Arecibo Observatory.

The NPRM specifically proposes a hard limit of $70 + 10 \log (p)$ dB below 2300 MHz for both the fixed and mobile users of the WCS bands in order to protect the DSN

receivers. However, at the upper end of the band at 2360 MHz the standard limit of only $43 + 10 \log (p)$ dB is applied for both fixed and mobile occupants. Since the criteria for the DSN receivers are identical to those of the Arecibo Planetary Radar, it is necessary that these same more stringent limits also be applied to the upper end of the WCS band. The more stringent limits are in agreement with the 70 dB outer envelope for spurious limits proposed by the United States for the "All Services" category in the proceedings of TG1-3. The DARS operators suggest even more stringent limits on unwanted emissions than proposed by the Commission. Cornell would support tightening the limits even further.

To this end and analogous to the protection criteria for the DSN receivers, Cornell suggests that Sections 27.53(a)(1) and (2) be modified as follows:

- (1) For fixed operations including radiolocation: By a factor not less than $43 + 10 \log (p)$ dB on all frequencies between 2300 and 2305 MHz and in the 2360-2370 MHz bands; and not less than $70 + 10 \log (p)$ dB on all frequencies below 2300 MHz, between 2320-2345 MHz, and above 2370 MHz.
- (2) For mobile operations including radiolocation: By a factor not less than $43 + 10 \log (p)$ dB on all frequencies between 2300 and 2305 MHz, between 2320 and 2345 MHz, and between 2360 and 2370 MHz; and not less than $70 + 10 \log (p)$ dB on all frequencies below 2300 MHz and above 2370 MHz.

V. Coordination Requirements for WCS Equipment Operating in Puerto Rico

The Commission proposes to prohibit airborne and space-to-Earth applications in the 2305-2310 MHz band in order to protect the DSN receivers. NPRM at para. 35. Within the current NPRM, no such applications have been proposed for the 2360-2370 MHz band. Therefore, Cornell does not seek to prohibit any airborne or space-to-Earth WCS applications.

In addition, the Commission seeks to establish a WCS coordination zone for the Ft. Irwin Military Reservation. In this context, Cornell requests that coordination of WCS equipment also be required for operations within Puerto Rico and surrounding islands.³

VI. Conclusion

³ Cornell further requests that such coordination be added as part of the requirements instituted by the Puerto Rico Coordination Zone as currently considered by the Commission in ET Docket 96-2.

The Commission has sought comments on the relaxation of the required attenuation of unwanted emission from WCS equipment. NPRM at para. 35. For the Fixed and Mobile occupants of WCS, the spurious emission limits are more stringent than the technical standards proposed in TG1-3 for Recommendation ITU-R SM.329. Therefore, Cornell does not support any relaxation of the unwanted emission requirements for the Fixed and Mobile WCS occupants and has instead proposed the same values for the unwanted emission requirements at the upper end of the WCS band.

Cornell asserts that Section 27.53's reference to the Section 25.202(f) standard for the out-of-band and spurious emissions of DARS occupants are inadequate for the protection of the unique planetary radar operations at Arecibo Observatory in Puerto Rico. The standards of Section 25.202(f) are equivalent to the preliminary standards for Space Services in ITU-R SM.329. During the proceedings of TGI 1-3, these standards have been severely criticized because of their inadequacy for the protection of the Passive Services. Because the planetary radar requires the same protection as any radio astronomy observatory, Cornell again suggests more stringent unwanted emission standards for the DARS operators. Alternatively a specific spectral power flux density may be adopted for frequencies above 2370 MHz.

Respectfully submitted,

CORNELL UNIVERSITY

By: Willem Baan (RFB)

Willem A. Baan
Senior Research Associate
Arecibo Observatory and
Cornell University

Paul J. Feldman

Paul J. Feldman, Esq.
Counsel for Cornell University

Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street, 11th Floor
Rosslyn, VA 22209
(703) 812-0400

December 16, 1996

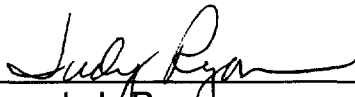
CERTIFICATE OF SERVICE

I, Judy Ryan, a secretary in the law firm of Fletcher, Heald & Hildreth, P.L.C., do hereby certify that true copies of the foregoing Reply Comments of Cornell University were sent this 16th day of December, 1996, United States First Class Mail, prepaid, to:

Lon C. Levin, Vice President
American Mobile Radio Corporation
10802 Parkridge Boulevard
Reston, VA 22091

Diane S. Hinson, Esq.
Cheryl A. Tritt, Esq.
Morrison & Foerster LLP
2000 Pennsylvania Avenue, NW, Suite 5500
Washington, DC 20006-1888
Counsel for Digital Satellite Broadcasting Corp.

Primosphere Limited Partnership
Leslie A. Taylor
Guy T. Christiansen
Leslie Taylor Associates
6800 Carlynn Court
Bethesda, MD 20817-4302



Judy Ryan